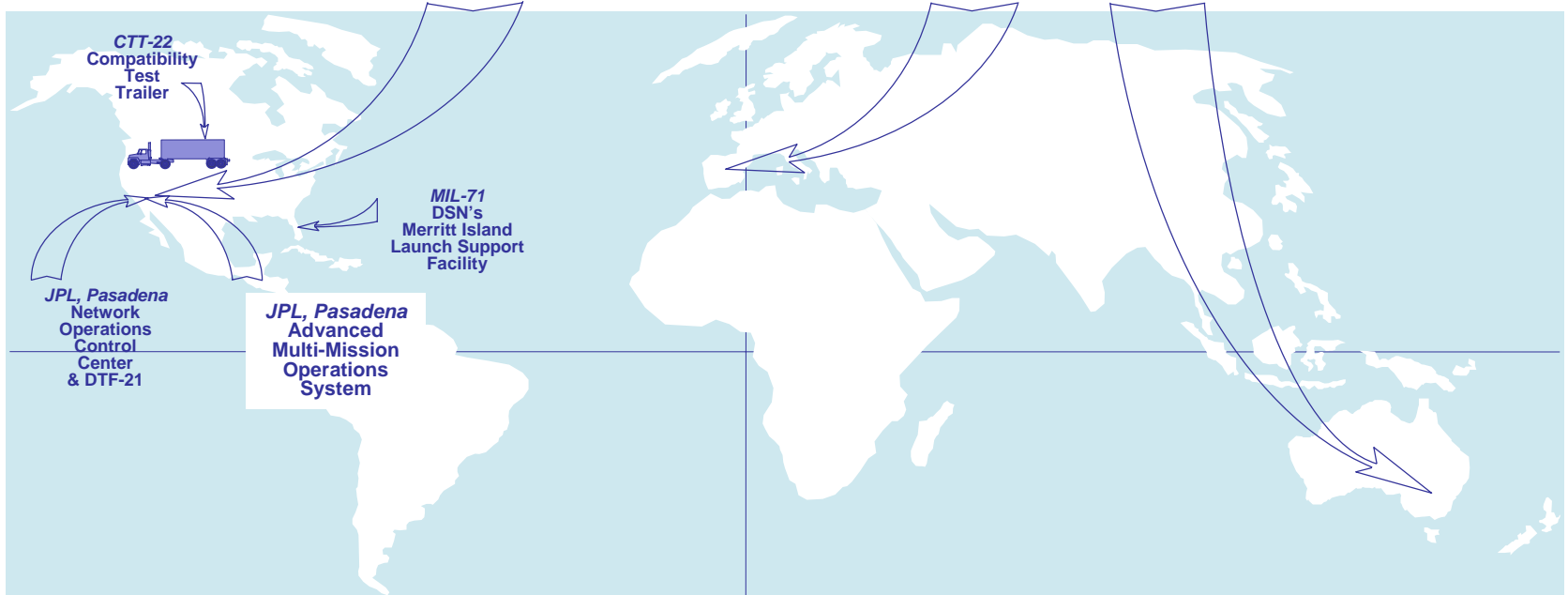
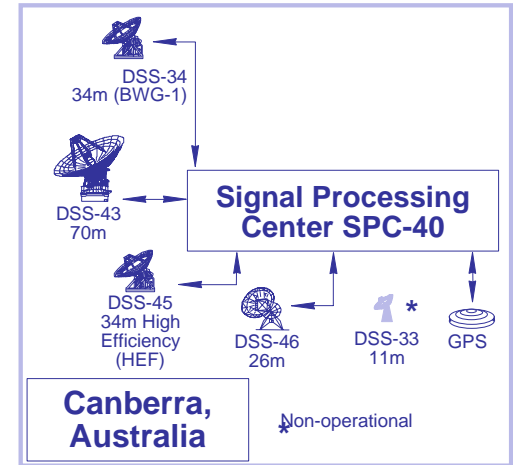
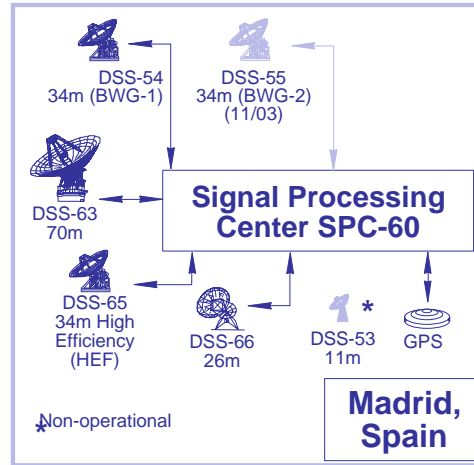
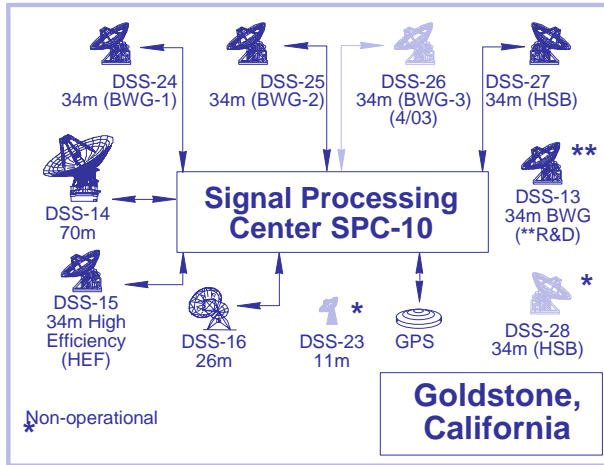


# **DSN frequency Transitions from L- to Ka-band**

Wallace Tai

Jet Propulsion Laboratory  
California Institute of Technology

# DSN Tracking Assets



# DSN Antenna Tracking Coverage

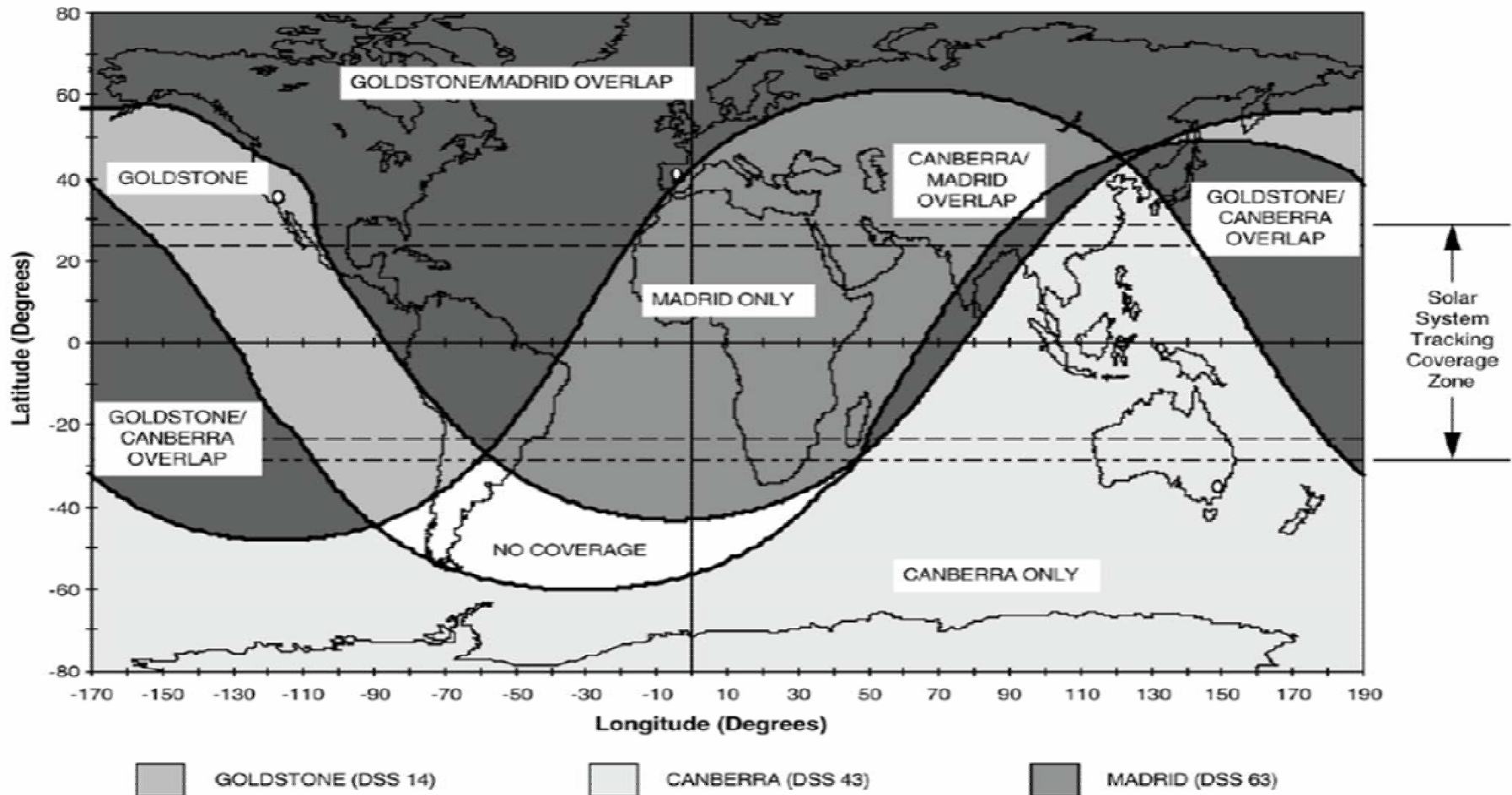


Figure 2. DSN 70-m Subnet Receive Coverage, Planetary Spacecraft

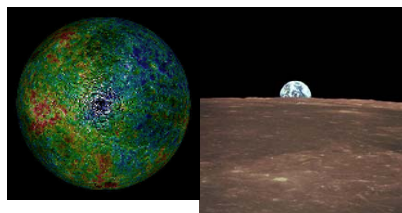
# Forty-six years of exploration



Giant Planets



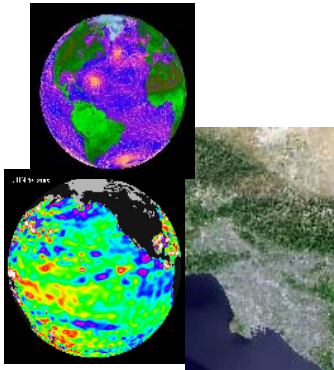
Small bodies



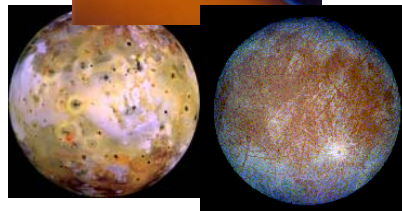
Earth's moon



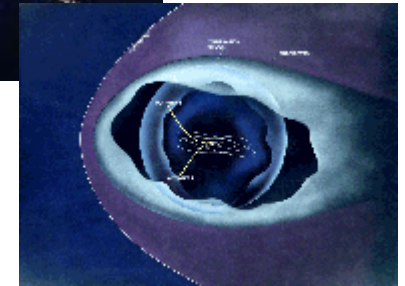
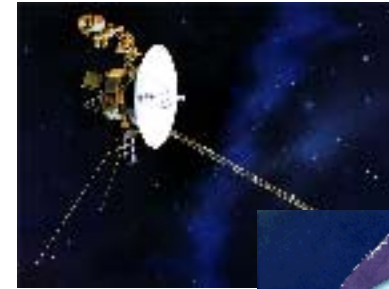
Astrophysics



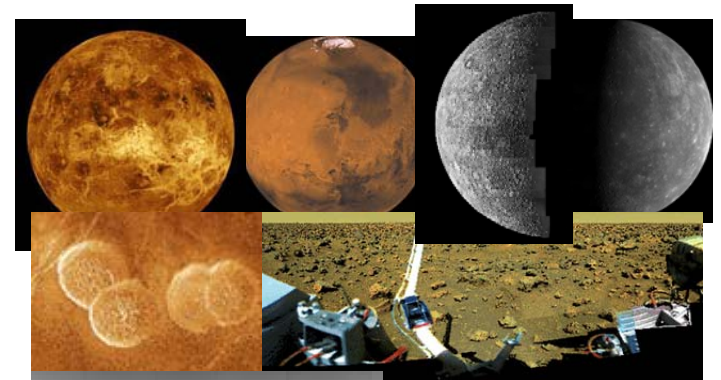
Earth



Planetary satellites



Interstellar space



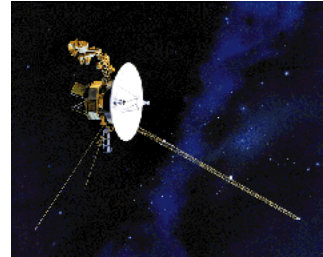
Terrestrial planets



Seventeen JPL spacecraft, and three major instruments, now operating across the solar system

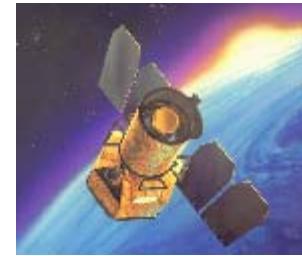
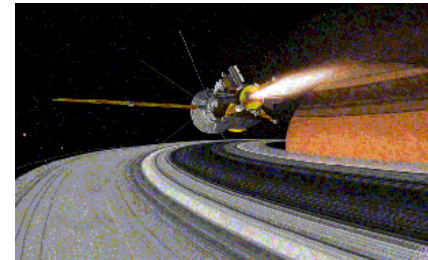


Spitzer studying stars and galaxies in the infrared



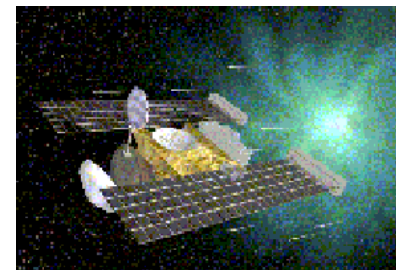
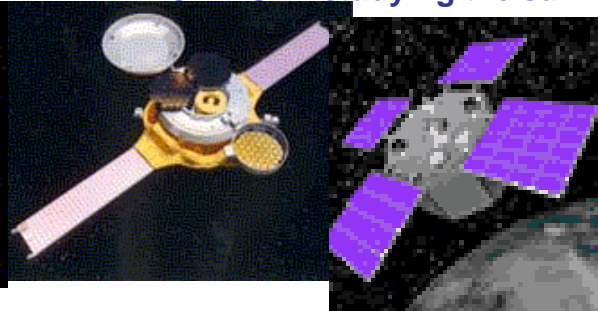
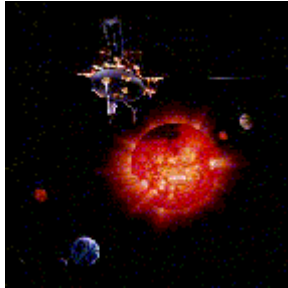
Two Voyagers on an interstellar mission

Cassini studying Saturn

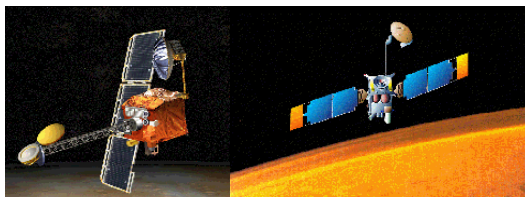
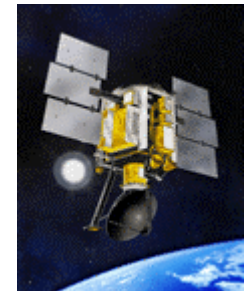


GALEX studying UV universe

Ulysses, Genesis, and ACRIMSAT studying the sun



Stardust returning comet dust



Mars Global Surveyor and Mars Odyssey orbiters; "Spirit" and "Opportunity" on Mars



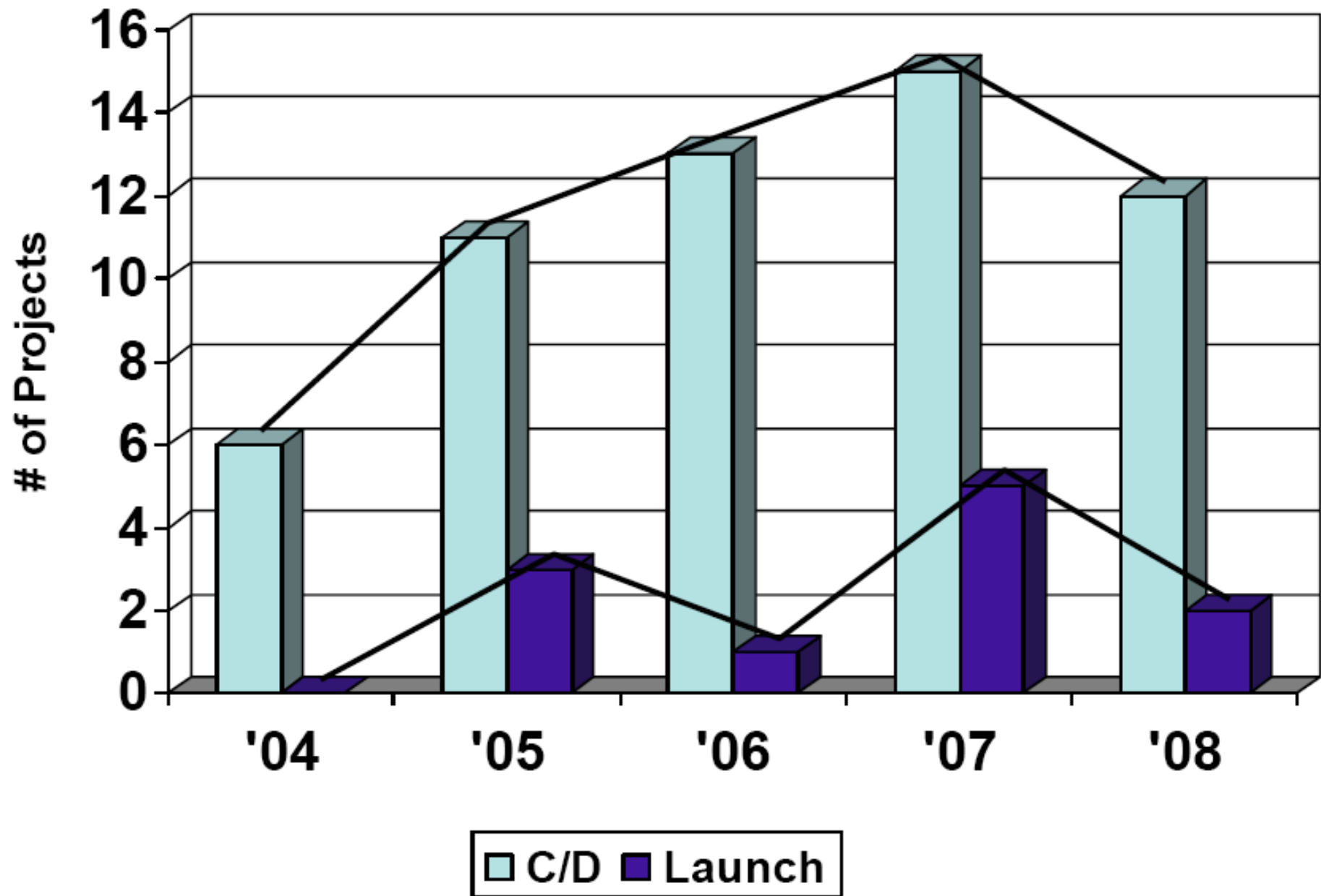
Deep Impact: comet material analysis

Topex/Poseidon, QuikSCAT, Jason 1, and GRACE (plus ASTER, MISR, and AIRS instruments) monitoring Earth



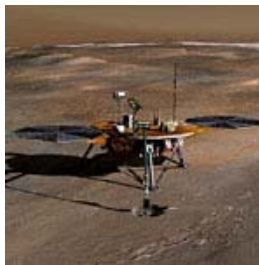
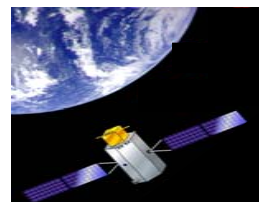
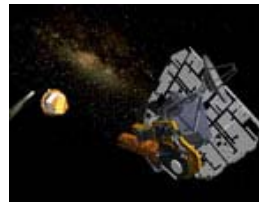
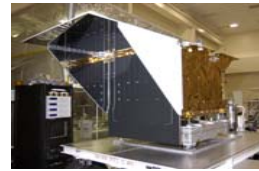
# Mission Development and Launch

## FY'04 – FY'08

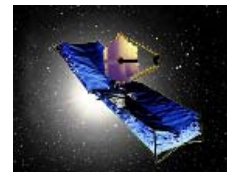
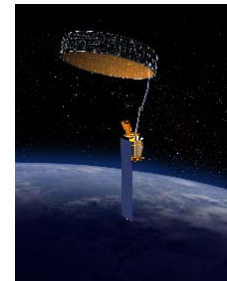
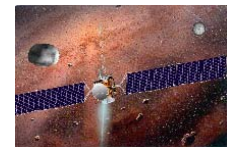


# Future JPL missions

- MLS/TES on EOS-AURA (6/04)
- Cloudsat (4/05): cloud monitoring
- Mars Reconnaissance Orbiter (MRO) (8/05)
- Actuated Hybrid Mirror/X-Sat with NRO (2/06)
- Dawn (5/06): study asteroids Ceres and Vesta
- ST7 Disturbance Reduction System(7/06)
- Herschel/Planck (4/07)
- Orbiting Carbon Observatory (8/07)
- Phoenix polar lander (9/07)
- Ocean Surface Topography Mission (10/07)
- Kepler (10/07): Extra-solar planet transits
- Primary Atomic Clocks in Space (PARCS)(1/08)



- Wide-field Infrared Explorer (WISE) (4/08)
- Aquarius (9/08): Ocean salt for heat transfer
- Mars Telesat (10/09)
- Mars Science Laboratory (MSL) (10/09)
- Space Interferometry Mission (SIM) (12/09)
- Hydros (09): Soil moisture
- Lunar lander (09)
- New Frontier I (09)
- Mars lander (11)
- Mid-infrared instrument (MIRI) on the James Webb Space Telescope payload (6/11)
- New Frontier II (12)
- Mars sample return (13)
- Jupiter Icy Moons Orbiter (13)
- Laser Interferometer Space Antenna (LISA) (13)
- Terrestrial Planet Finder (15)



# Table 1. Frequency Bands at Various Deep Space Stations

Complex	DSS ID	Size (Meters)	Type	Uplink	Downlink
Goldstone	14	70	D.S. <sup>1</sup>	S,X	S,X,Ka(TBD)
	15	34	HEF	X	S,X,Ka(TBD)
	16	26	E.O. <sup>2</sup>	S	S,X
	24	34	BWG1 <sup>1,2</sup>	S,X	S,X,Ka(10/06)
	25	34	BWG2 <sup>1</sup>	X,Ka	X,Ka
	26	34	BWG2 <sup>1</sup>	X	X,Ka <sup>3</sup>
	27	34	HSB <sup>2</sup>	S	S
Canberra	34	34	BWG1 <sup>1,2</sup>	S,X	S,X,Ka(04/05)
	43	70	D.S. <sup>1</sup>	S,X	S,X,Ka(TBD)
	45	34	HEF <sup>1</sup>	X	S,X,Ka(TBD)
	46	26	E.O. <sup>2</sup>	S	S,X
Madrid	54	34	BWG1 <sup>1,2</sup>	S,X	S,X,Ka(08/07)
	55	34	BWG2 <sup>1</sup>	X	X,Ka <sup>3</sup>
	63	70	D.S. <sup>1</sup>	S,X	S,X,Ka(TBD)
	65	34	HEF <sup>1</sup>	X	S,X,Ka(TBD)
	66	34	E.O. <sup>2</sup>	S	S

<sup>1</sup> These stations used for Deep Space (Category B) missions

<sup>2</sup> These stations used for Earth Orbiting (Category A) missions

<sup>3</sup> Not committed



Table 2. Higher frequencies, smaller wavelengths,  
larger weather effects

Band	Frequency (GHz)	Wavelength (cm)
L	1 - 2	20 (@ 1.5GHz)
S	2 - 4	15 (@ 2GHz)
C	4 - 8	7.5 (@ 4GHz)
X	8 - 12	3.75 (@ 8GHz)
J/Ku	10 - 20	1.7 (@ 18GHz)
K	18 - 26.5	1.5 (@ 20GHz)
Q/Ka	26.5 - 40	1.0 (@ 30GHz)